# FCC 47 CFR PART 15 SUBPART C
# INDUSTRY CANADA RSS-210 ISSUE 8
# CERTIFICATION TEST REPORT

**FOR**

**CELLULAR PHONE WITH BLUETOOTH AND WLAN RADIOS**

**MODEL NUMBER: A1549**

**FCC ID: BCG-E2816A**
**IC: 579C-E2816A**

**REPORT NUMBER: 14U17673-E22, REVISION C**

**ISSUE DATE: SEPTEMBER 12, 2014**

*Prepared for*
**APPLE, INC.**
**1 INFINITE LOOP**
**CUPERTINO, CA 95014, U.S.A.**

*Prepared by*
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NVLAP LAB CODE 200065-0

## Revision History

| Rev. | Issue Date | Revisions | Revised By |
|---|---|---|---|
| -- | 07/17/2014 | Initial Issue | C. Pang |
| A | 07/29/2014 | Revised Section 5.1, 5.4 and 8 | O. Su |
| B | 08/08/2014 | Address TCB's Questions | C. Pang |
| C | 09/12/2014 | Address TCB's Questions | O. Su |


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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** APPLE
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

**EUT DESCRIPTION:** CELLULAR PHONE WITH BLUETOOTH AND WLAN RADIOS

**MODEL:** A1549

**SERIAL NUMBER:** C39MR003G32J; C39MR0AEG33G

**DATE TESTED:** MAY 30, 2014 – JULY 03, 2014

| APPLICABLE STANDARDS | |
|---|---|
| **STANDARD** | **TEST RESULTS** |
| FCC PART 15 SUBPART C | Pass |
| INDUSTRY CANADA RSS-210 Issue 8, Annex 2 | Pass |
| INDUSTRY CANADA RSS-GEN Issue 3 | Pass |

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

Chin Pang
Senior Engineer
UL Verification Services Inc.

Tested By:

Oliver Su
Senior Engineer
UL Verification Services Inc


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# 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, and FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

# 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

| 47173 Benicia Street | 47266 Benicia Street |
|---|---|
| ☐ Chamber A | ☒ Chamber D |
| ☐ Chamber B | ☐ Chamber E |
| ☐ Chamber C | ☐ Chamber F |
| | ☐ Chamber G |
| | ☒ Chamber H |

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

# 4. CALIBRATION AND UNCERTAINTY

## 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m


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## 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---|---|
| Conducted Disturbance, 0.15 to 30 MHz | ±3.52 dB |
| Radiated Disturbance, 30 to 1000 MHz | ±4.94 dB |

Uncertainty figures are valid to a confidence level of 95%.


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# 5. EQUIPMENT UNDER TEST

## 5.1. DESCRIPTION OF EUT

Model A1549 is a mobile phone with multimedia functions (music, application support, and video), Cellular GSM/GPRS/EGPRS/CDMA2000/EVDO Rev.A/ EVDO Rev.B /WCDMA/HSPA+/DC-HSDPA/LTE FDD & Carrier Aggregation radio, IEEE 802.11a/b/g/n/ac radio, Bluetooth radio and NFC ( a tag device). The rechargeable battery is not user accessible.

## 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak radiated output power as follows:

| Frequency Range (MHz) | Mode | E Field At 30 m Distance (dBuV/m) |
|---|---|---|
| 14.424 | Type A | 4.55 |
| 14.394 | Type B | 10.19 |

## 5.3. SOFTWARE AND FIRMWARE

The test utility software used during testing was Star Links 1.9.

## 5.4. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT with dummy load, set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X (Flatbed), Y (Landscape), Z (Portrait) and Y orientation was determined to be the worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z (Portrait) orientation.

Worst case of radiated emission test below 30MHz was found on antenna face-on orientation.

## 5.5. MODIFICATIONS

No modifications were made during testing.


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## 5.6. DESCRIPTION OF TEST SETUP

**SUPPORT EQUIPMENT**

| Support Equipment List | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Serial Number** | **FCC ID** |
| AC/DC adapter | Apple | A1401 | 60812 | NA |
| Earphone | Apple | NA | NA | NA |

**I/O CABLES**

| I/O Cable List | | | | | | |
|---|---|---|---|---|---|---|
| **Cable No** | **Port** | **# of identical ports** | **Connector Type** | **Cable Type** | **Cable Length (m)** | **Remarks** |
| 1 | AC | 1 | US115 | Un-Shielded | 80cm | NA |
| 2 | DC | 1 | USB | Un-Shielded | 1m | NA |
| 3 | Audio | 1 | Jack | Un-Shielded | 0.5m | NA |


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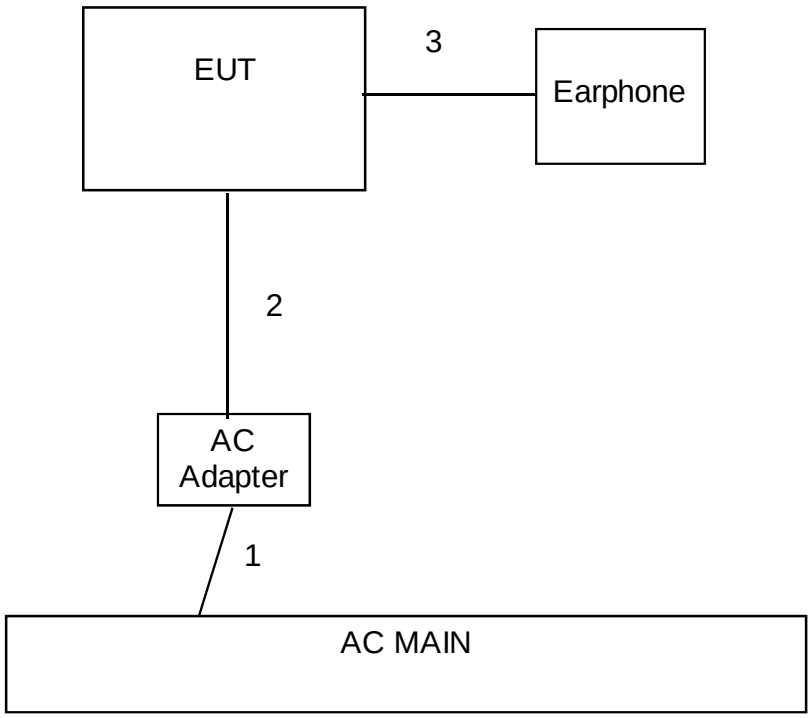
**SETUP DIAGRAM FOR TESTS**





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# 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

| TEST EQUIPMENT LIST | | | | |
|---|---|---|---|---|
| **Description** | **Manufacturer** | **Model** | **Asset** | **Cal Due** |
| Spectrum Analyzer, 44 GHz | Agilent / HP | N9030A | F00129 | 02/22/15 |
| Antenna, Bilog, 2 GHz | Sunol Sciences | JB1 | F00168 | 03/28/15 |
| Preamplifier, 1300 MHz | Sonoma | 310 | F00008 | 05/27/15 |
| Loop Antenna | ETS Lindgren | 6502 | F00370 | 10/04/14 |
| Close-Field Probe | Agilent / HP | 11941A | N02873 | 08/15/14 |
| Temperature Chamber | Cincinnati Sub Zero | ZPHS-8-3.5-SCT/WC | F00363 | 10/11/14 |
| EMI Test Receiver, 9 KHz-7 GHz | R & S | ESCI 7 | F00092 | 09/05/14 |
| LISN, 30 MHz | FCC | LISN-50/250-25-2 | C00626 | 01/14/15 |


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# 7. OCCUPIED BANDWIDTH

## LIMITS

None; for reporting purposes only.

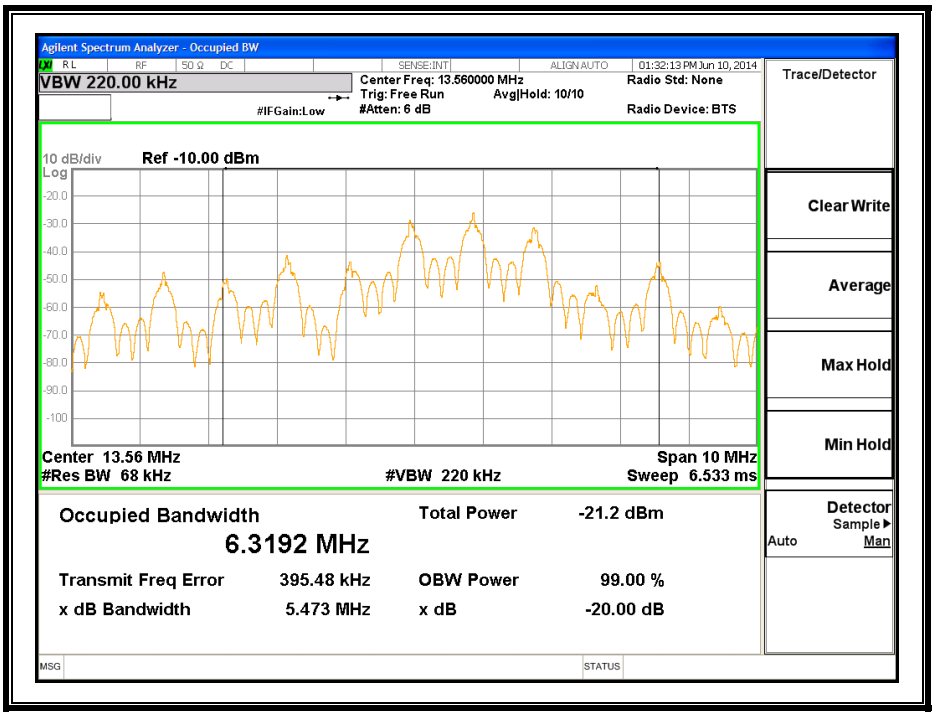
## TEST PROCEDURE

The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

## RESULTS

| Moduation | Frequency (MHz) | 99% Bandwidth (MHz) |
|---|---|---|
| Type A | 13.56 | 6.3192 |
| Type B | 13.56 | 6.2906 |

Type A





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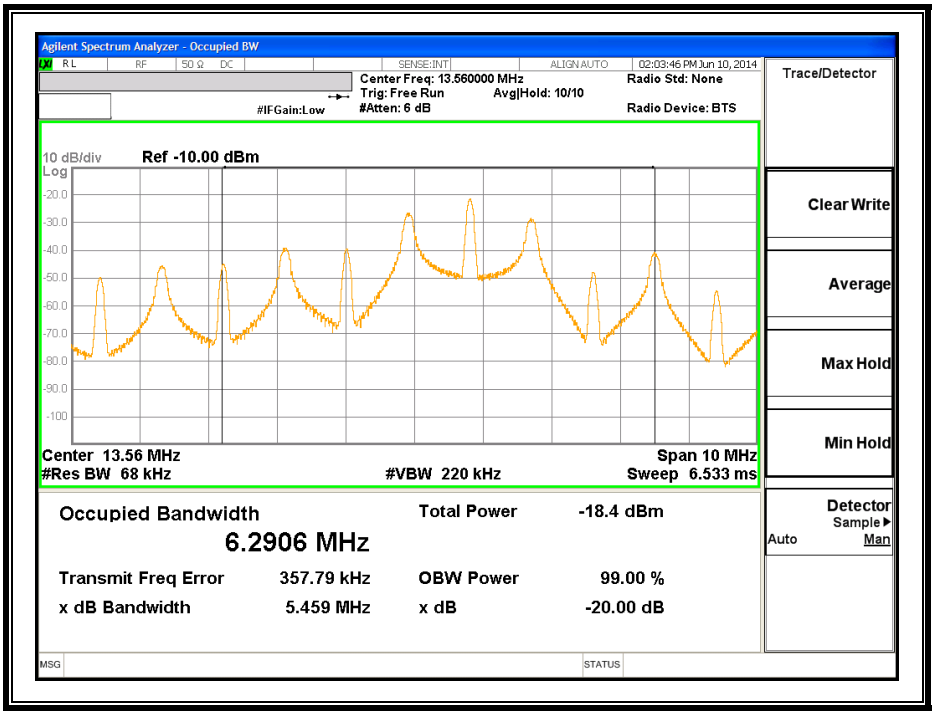
Type B



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# 8. RADIATED EMISSION TEST RESULTS

## 8.1. LIMITS AND PROCEDURE

**LIMIT**

§15.225
IC RSS-210, Section 2.6 (Transmitter)
IC RSS-GEN, Section 6 (Receiver)

(a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz and shall not exceed the general radiated emission limits in § 15.209 as follows:
§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Limits for radiated disturbance of an intentional radiator | | |
|---|---|---|
| Frequency range (MHz) | Limits (µV/m) | Measurement Distance (m) |
| 0.009 – 0.490 | 2400 / F (kHz) | 300 |
| 0.490 – 1.705 | 24000 / F (kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100** | 3 |
| 88 - 216 | 150** | 3 |
| 216 – 960 | 200** | 3 |
| Above 960 | 500 | 3 |

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, however, operation within these frequency bands is permitted under other sections of this part, e.g. §§ 15.231 and 15.241.
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

Formula for converting the filed strength from uV/m to dBuV/m is:
Limit (dBuV/m) = 20 log limit (uV/m)


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In addition:

§15.209 (d) The emission limits shown the above table is based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emissions limits in these three bands are based on measurements employing an average detector.

§15.209 (d) The provisions in §§ 15.225, measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

**TEST PROCEDURE**

ANSI C63.4, 2009

The EUT is an intentional radiator that incorporates a digital device, the highest fundamental frequency generated or used in the device is 13.56 MHz; therefore, the frequency range was investigated from 0.15 MHz to the $10^{th}$ harmonic of the highest fundamental frequency, or 1000 MHz, whichever is greater.

**RESULTS**

Offset = 40*log (3/30) + Antenna Factor
Offset = -40 dB + 11 dB = -29 dB


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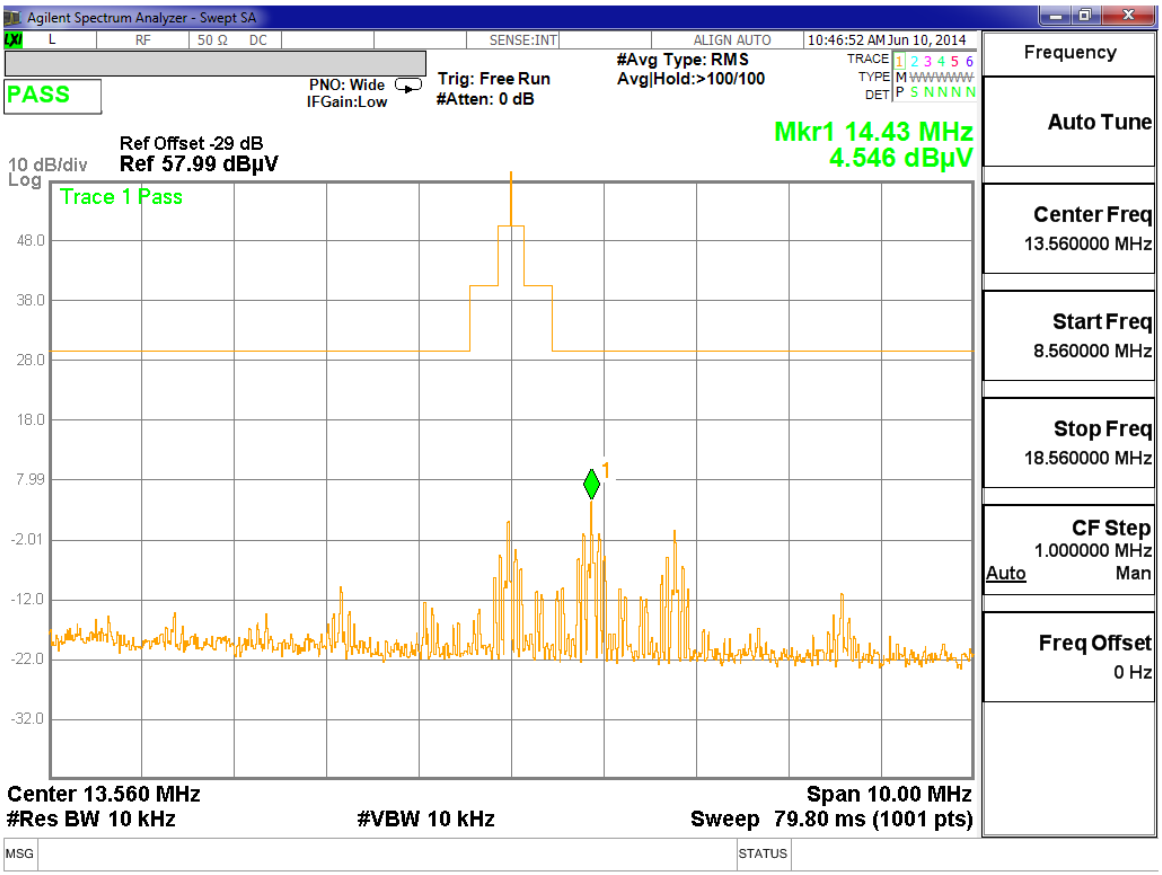
## TYPE A FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz),

**TYPE A, 424 Kbps, ANTENNA FACE ON**

13.56 MHz





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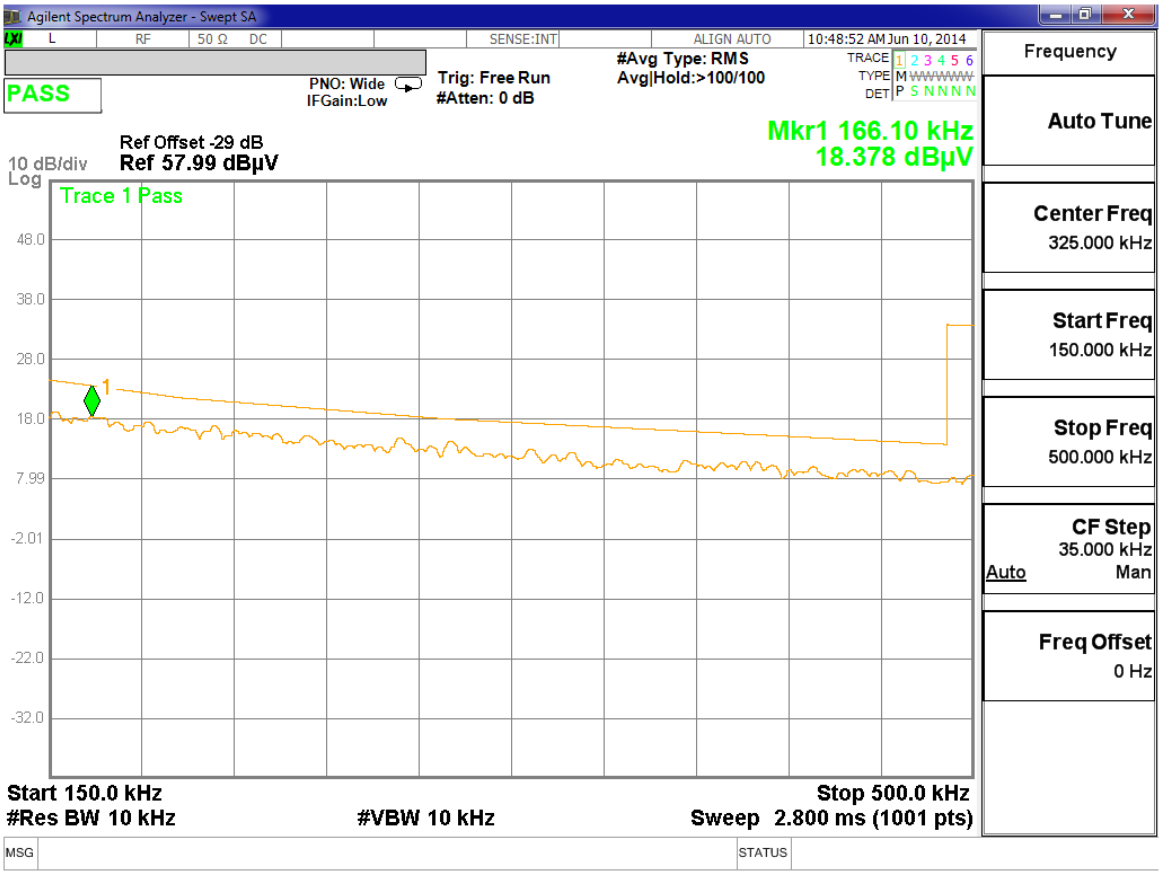
150 KHz – 500 KHz



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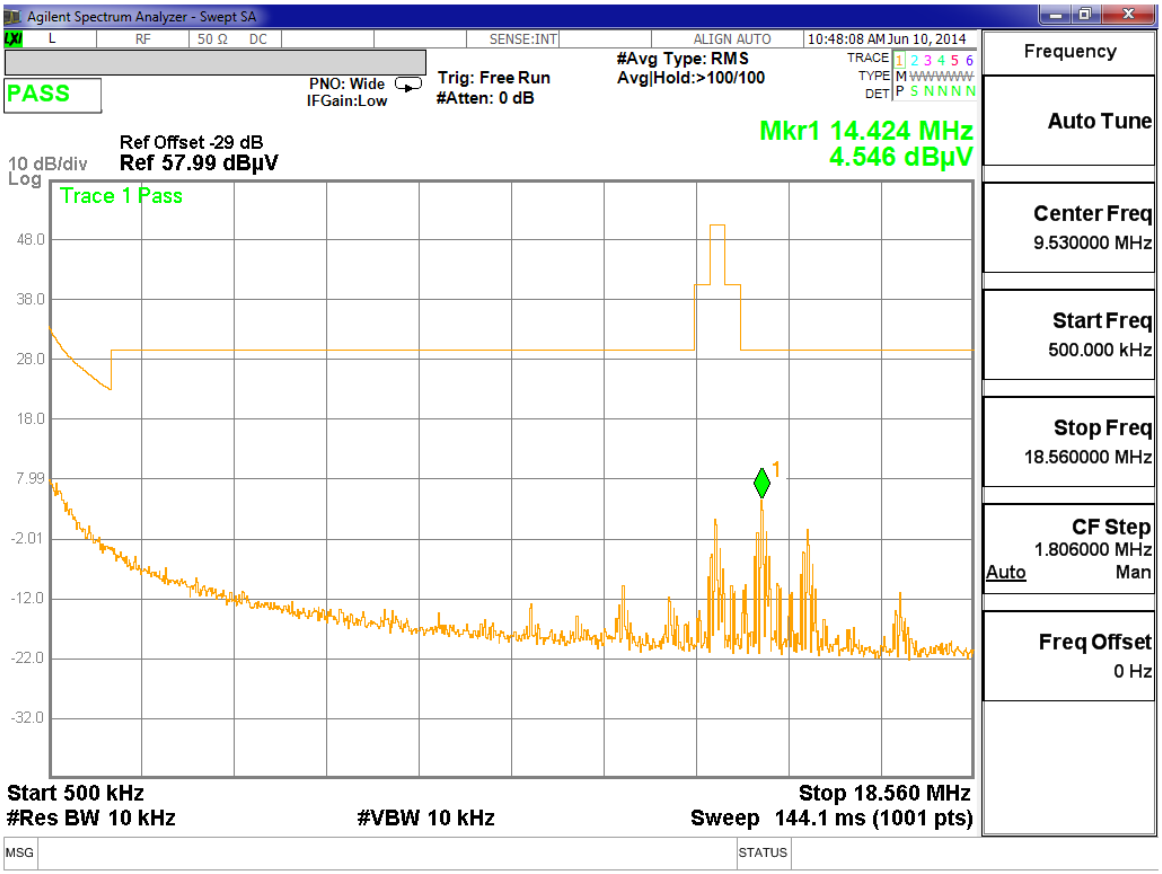
500 KHz – 30 MHz



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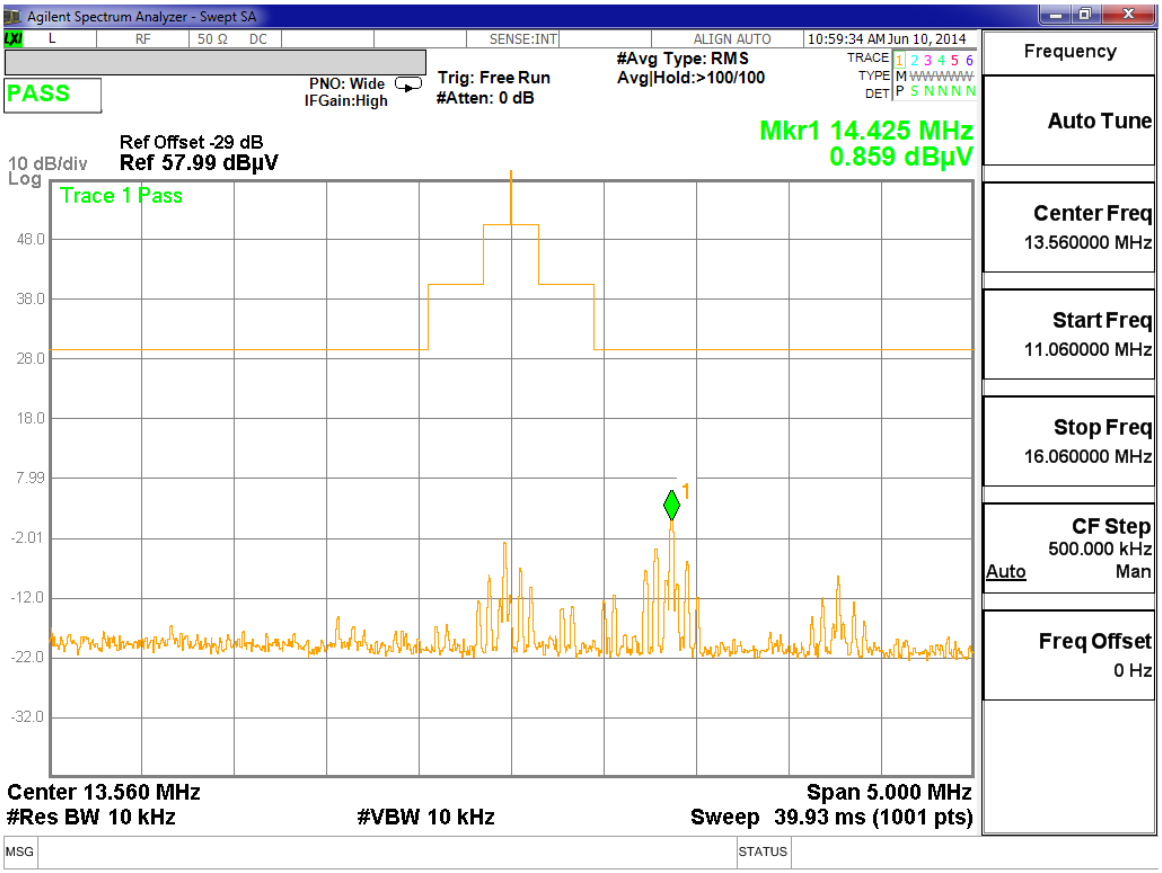
**TYPE A, 424 Kbps, ANTENNA FACE OFF**

13.56 MHz



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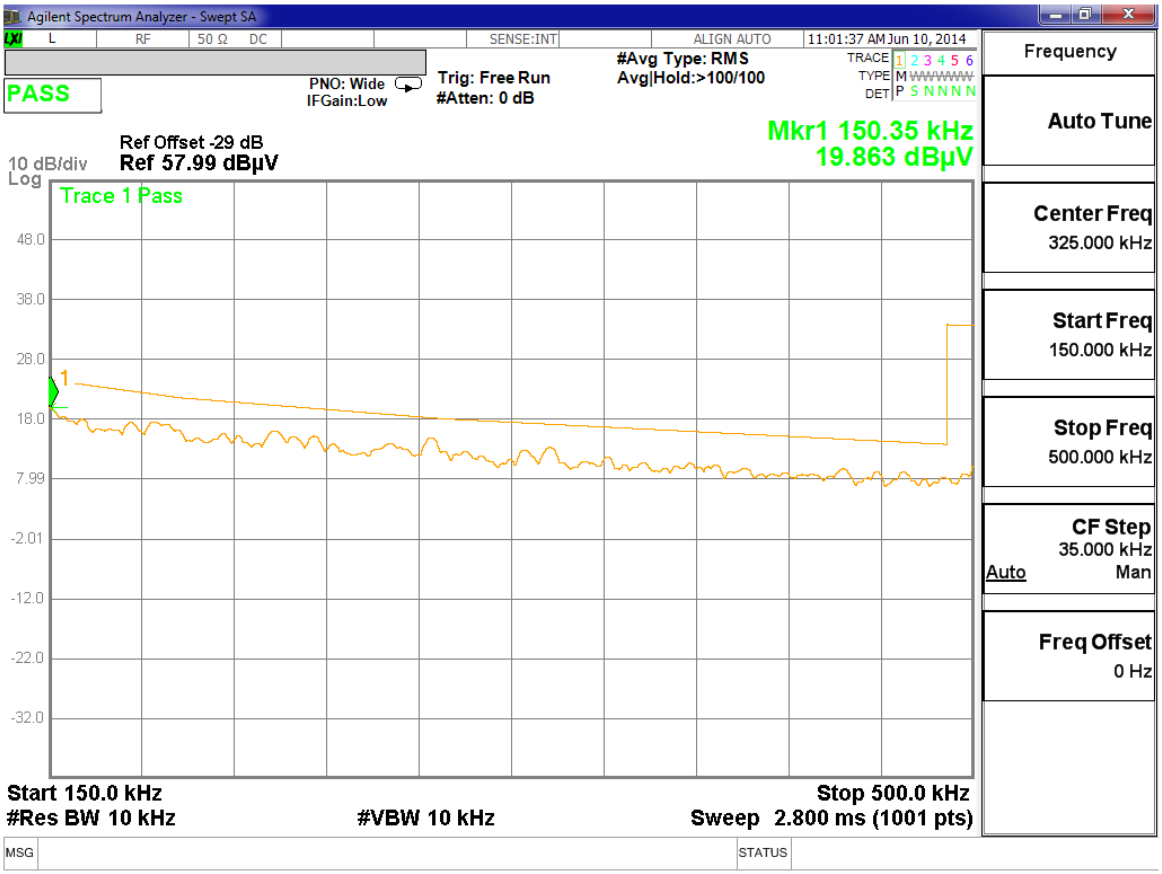
150 KHz – 500 KHz



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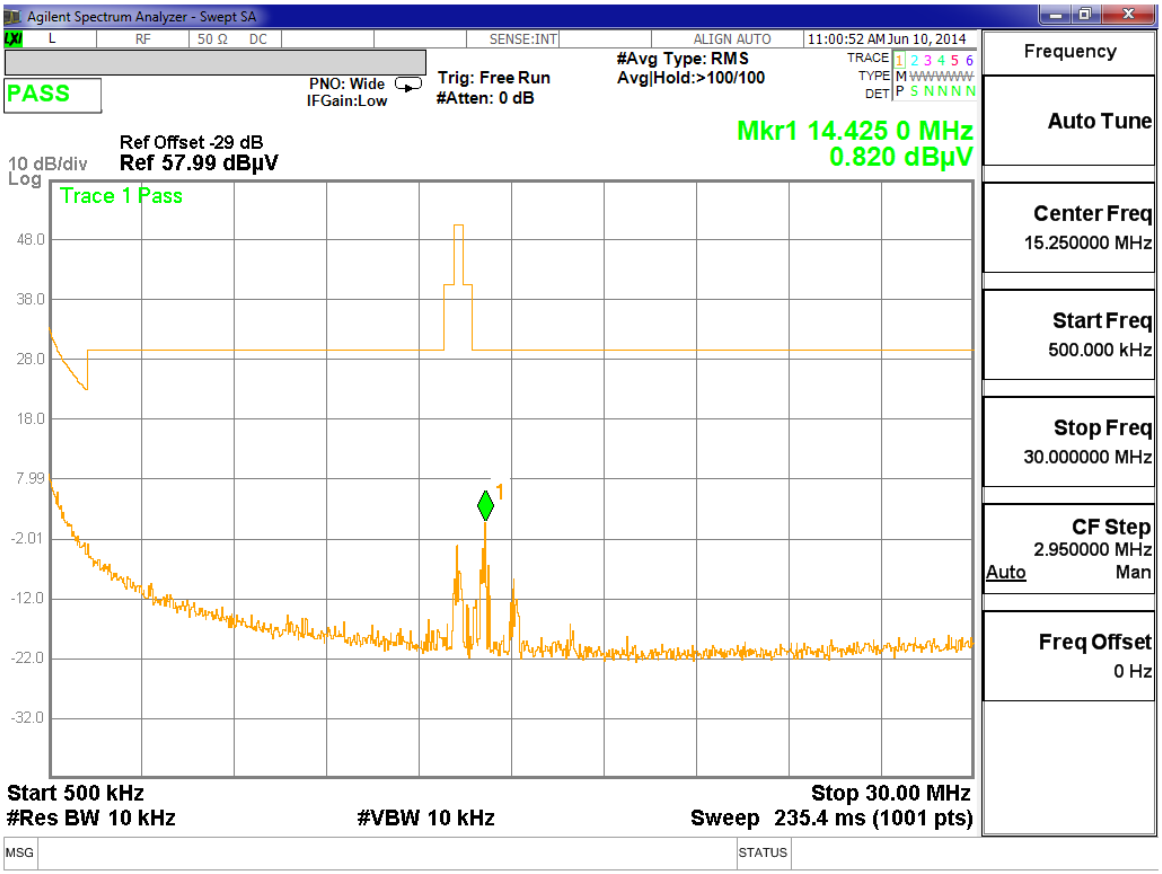
500 KHz – 30 MHz



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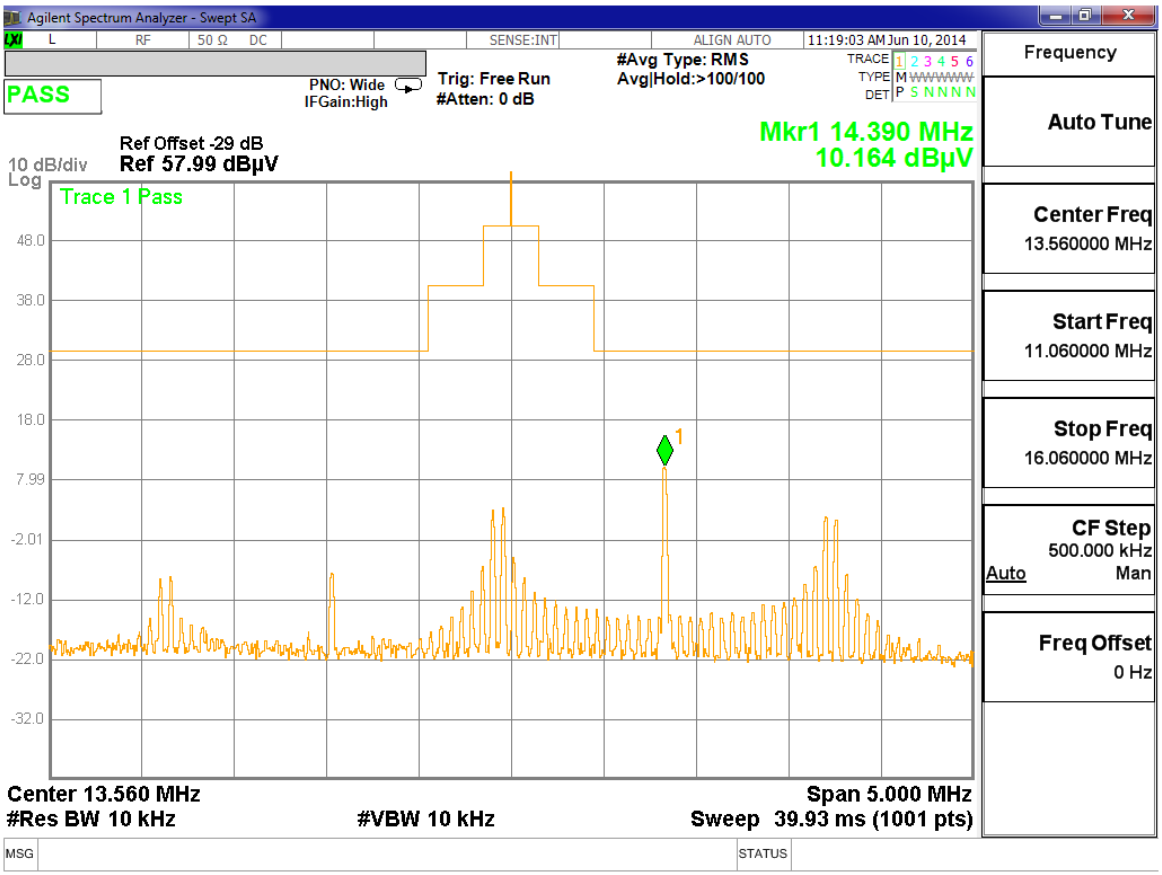
## 8.1.1. TYPE B FUNDAMENTAL AND SPURIOUS EMISSIONS (0.15 – 30 MHz)

**TYPE B, 424 Kbps, ANTENNA FACE ON**

13.56 MHz





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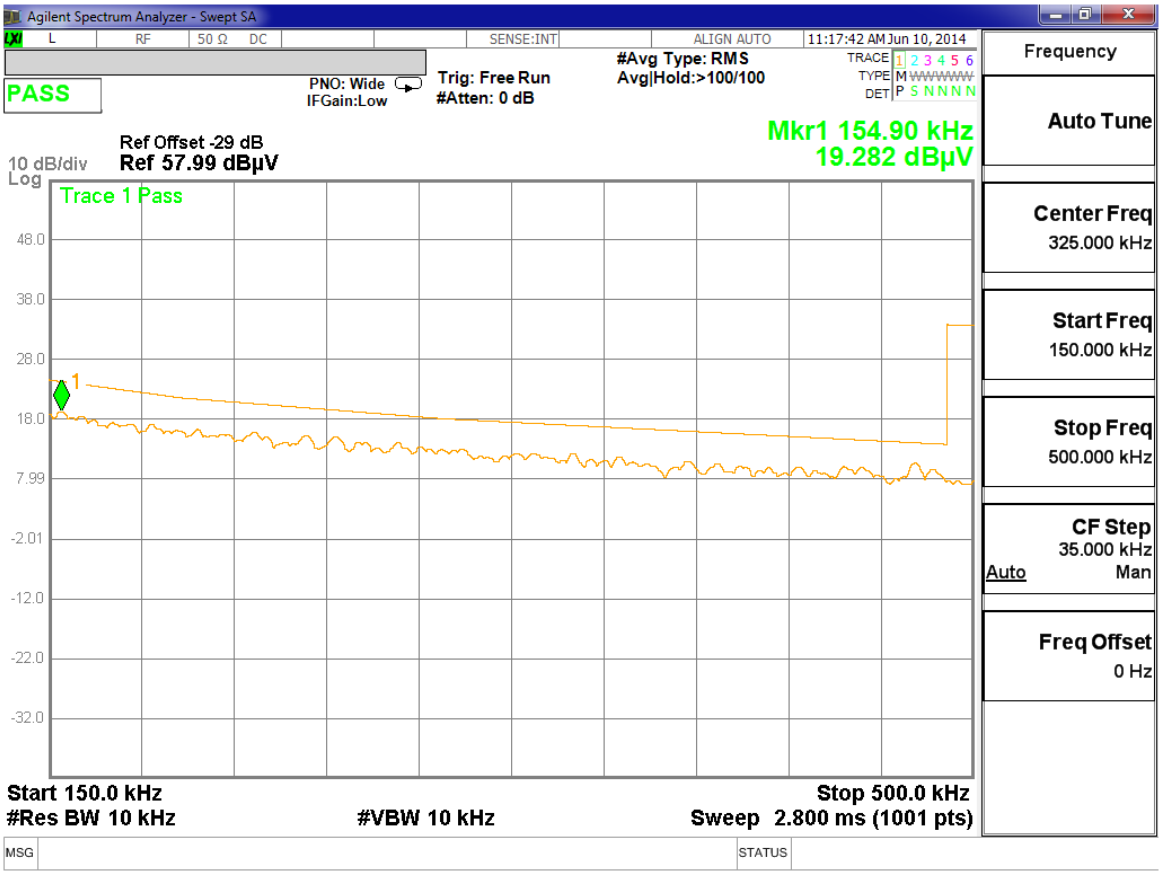
150 KHz – 500 KHz



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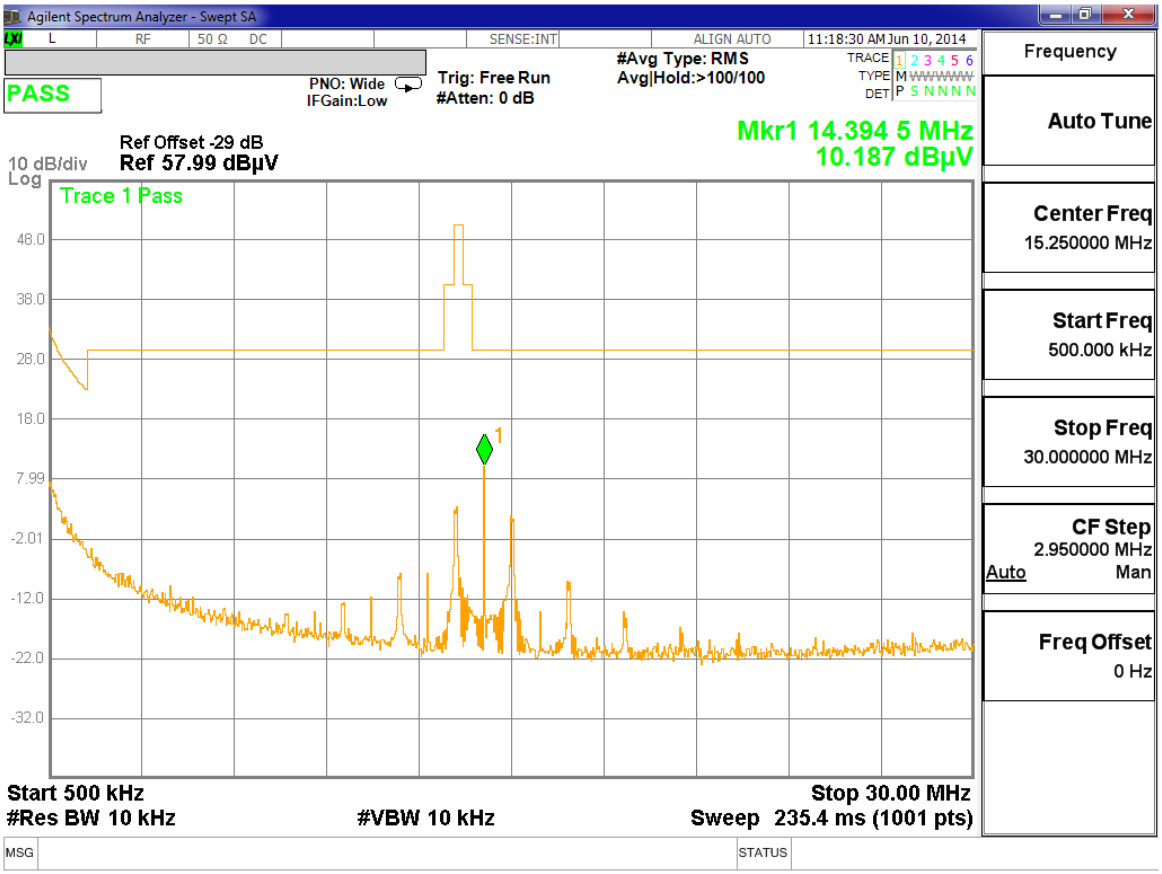
500 KHz – 30 MHz



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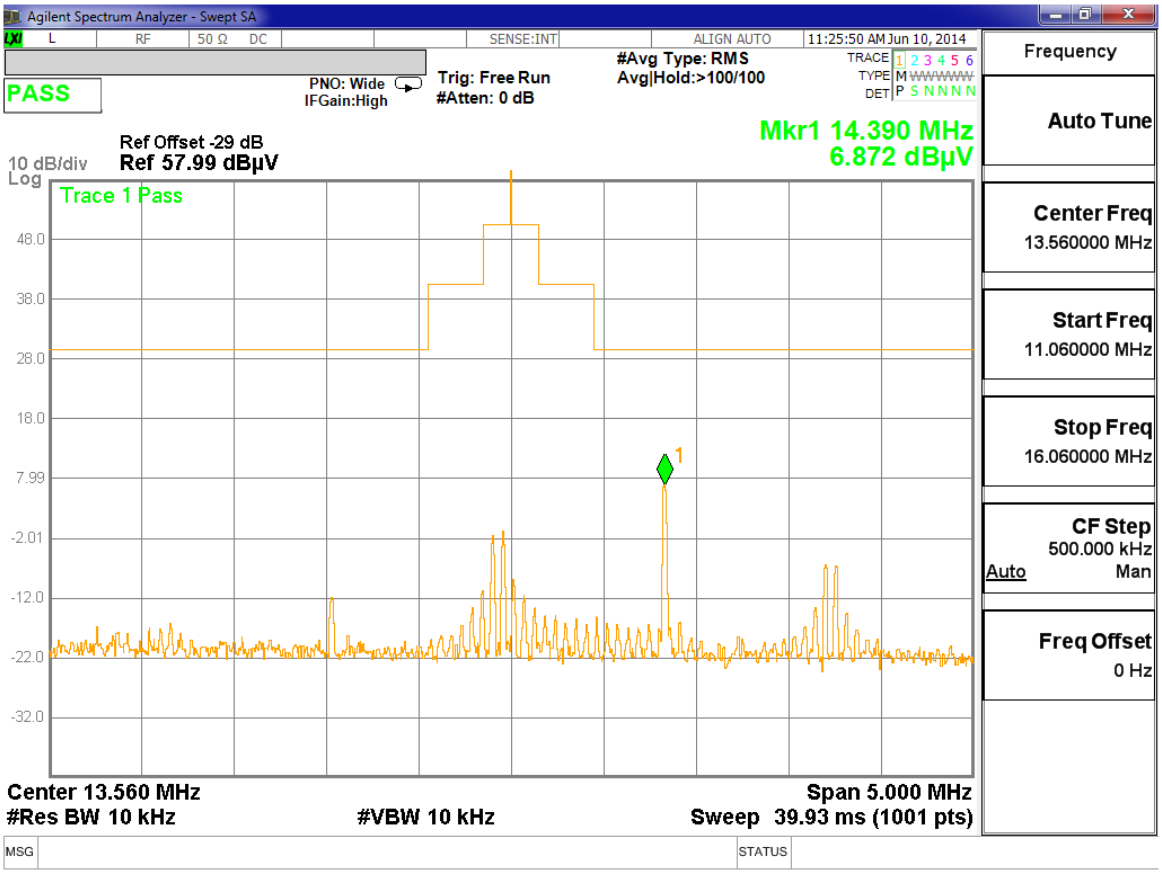
**TYPE B, 424 Kbps, ANTENNA FACE OFF**

13.56 MHz



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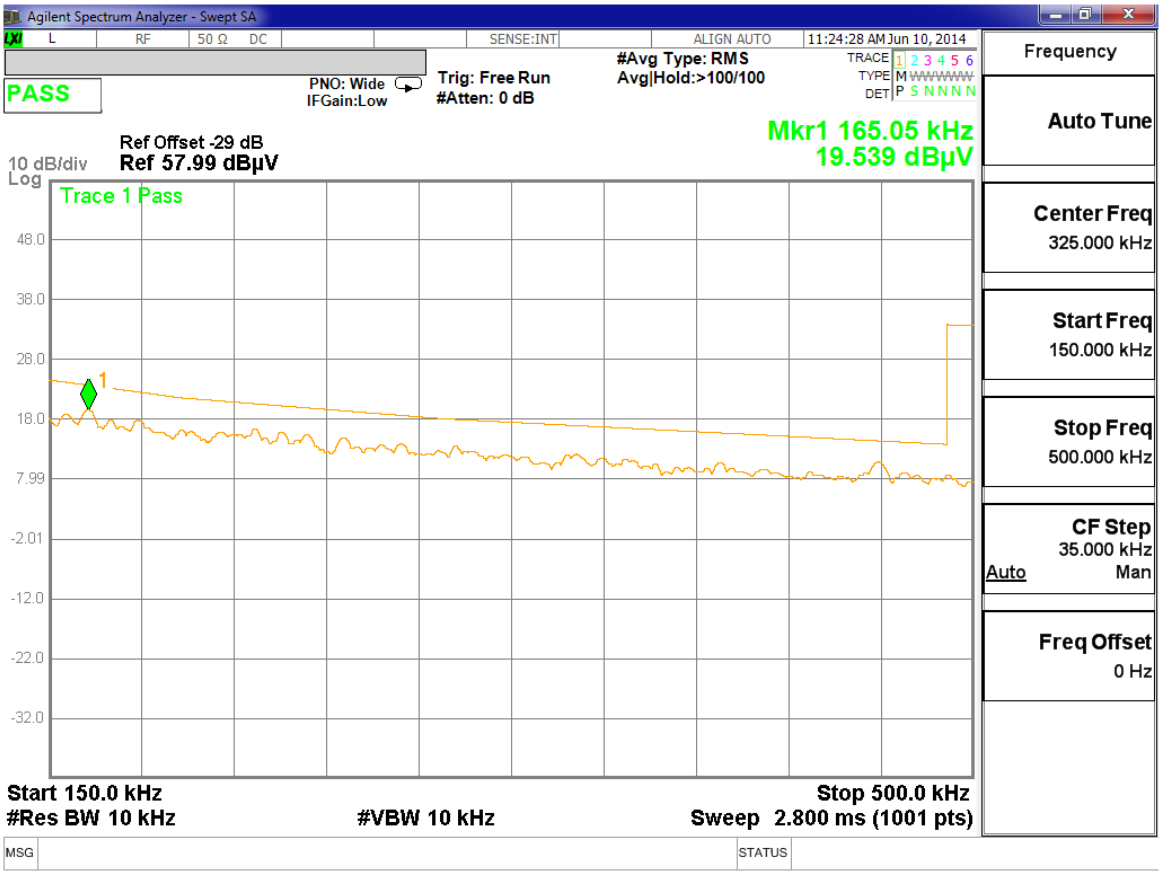
150 KHz – 500 KHz



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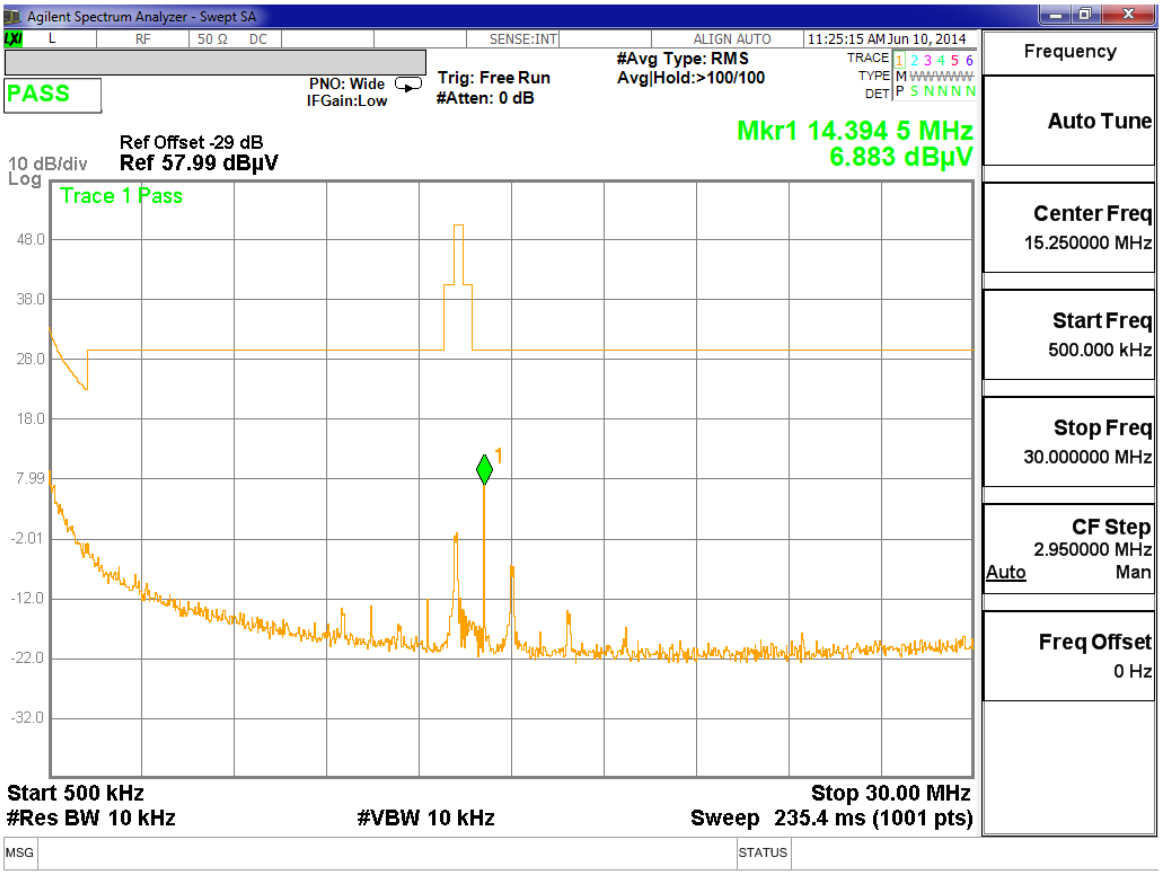
500 KHz – 30 MHz







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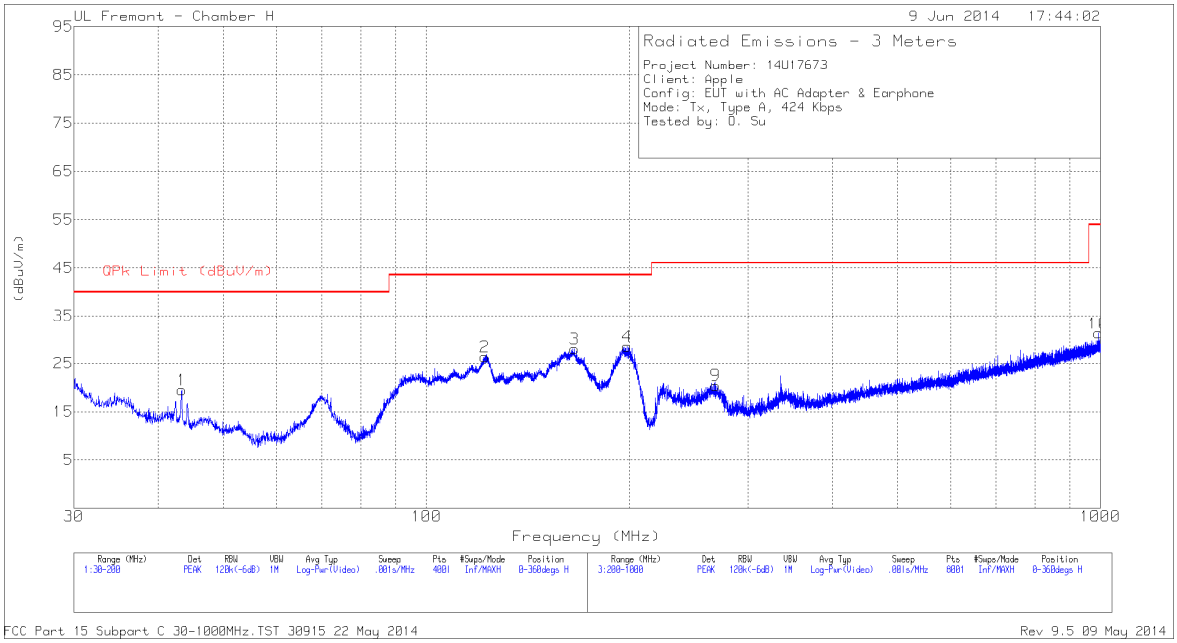
## 8.1.2. TYPE A TX SPURIOUS EMISSION 30 TO 1000 MHz

**TYPE A, 424 Kbps**

HORIZONTAL PLOT





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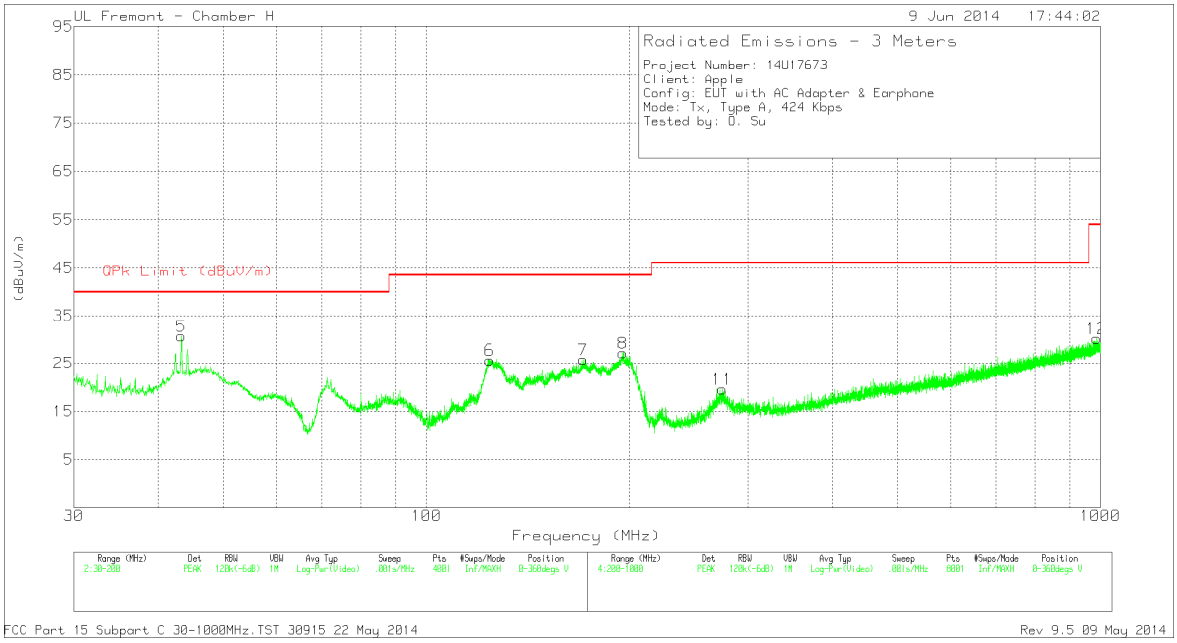
## VERTICAL PLOT



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## HORIZONTAL AND VERTICAL DATA

Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | SS JB3 SN A051314-1 | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | * 122.0125 | 39.54 | PK | 16.7 | -29.9 | 26.34 | 43.52 | -17.18 | 0-360 | 200 | H |
| 3 | * 165.83 | 42.48 | PK | 15 | -29.5 | 27.98 | 43.52 | -15.54 | 0-360 | 200 | H |
| 6 | * 124.0525 | 38.76 | PK | 16.8 | -29.9 | 25.66 | 43.52 | -17.86 | 0-360 | 100 | V |
| 7 | * 170.93 | 40.54 | PK | 14.7 | -29.5 | 25.74 | 43.52 | -17.78 | 0-360 | 100 | V |
| 9 | * 268.6 | 33.36 | PK | 15.8 | -28.7 | 20.46 | 46.02 | -25.56 | 0-360 | 100 | H |
| 10 | * 992.5 | 29.19 | PK | 26.3 | -24.2 | 31.29 | 53.97 | -22.68 | 0-360 | 100 | H |
| 11 | * 274.6 | 32.23 | PK | 16.1 | -28.7 | 19.63 | 46.02 | -26.39 | 0-360 | 100 | V |
| 12 | * 987.1 | 28.24 | PK | 26.2 | -24.3 | 30.14 | 53.97 | -23.83 | 0-360 | 200 | V |
| 5 | 43.3025 | 46.76 | PK | 14.7 | -30.8 | 30.66 | 40 | -9.34 | 0-360 | 100 | V |
| 1 | 43.345 | 35.6 | PK | 14.7 | -30.8 | 19.5 | 40 | -20.5 | 0-360 | 400 | H |
| 8 | 195.5375 | 41.54 | PK | 14.9 | -29.3 | 27.14 | 43.52 | -16.38 | 0-360 | 100 | V |
| 4 | 198.5125 | 42.29 | PK | 15.4 | -29.2 | 28.49 | 43.52 | -15.03 | 0-360 | 98 | H |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

FCC Part 15 Subpart C 30-1000MHz.TST 30915 22 May 2014

Rev 9.5 09 May 2014


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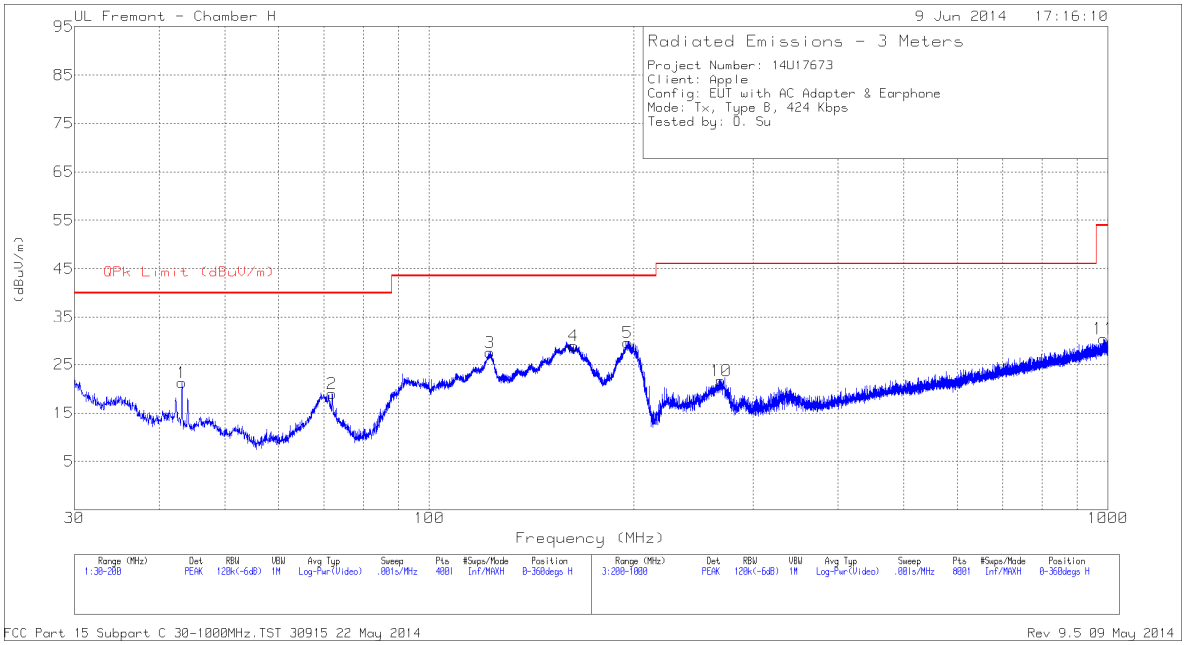
## 8.1.3. TYPE B TX SPURIOUS EMISSION 30 TO 1000 MHz

**TYPE B, 424 Kbps**

HORIZONTAL PLOT



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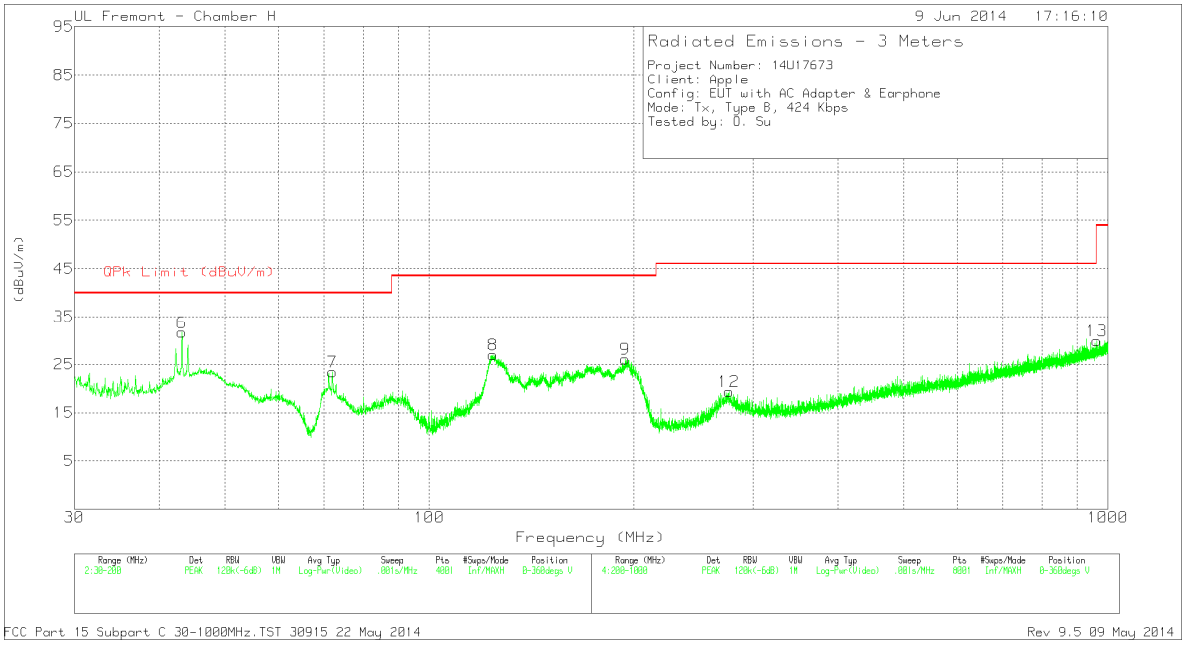
## VERTICAL PLOT



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## HORIZONTAL AND VERTICAL DATA

Trace Markers

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | SS JB3 SN A051314-1 | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | * 122.7775 | 40.73 | PK | 16.7 | -29.9 | 27.53 | 43.52 | -15.99 | 0-360 | 200 | H |
| 4 | * 163.195 | 43.25 | PK | 15.1 | -29.5 | 28.85 | 43.52 | -14.67 | 0-360 | 200 | H |
| 8 | * 124.0525 | 40.09 | PK | 16.8 | -29.9 | 26.99 | 43.52 | -16.53 | 0-360 | 100 | V |
| 10 | * 269.3 | 34.68 | PK | 15.8 | -28.8 | 21.68 | 46.02 | -24.34 | 0-360 | 100 | H |
| 11 | * 985.3 | 28.46 | PK | 26.2 | -24.3 | 30.36 | 53.97 | -23.61 | 0-360 | 400 | H |
| 12 | * 276.3 | 32 | PK | 16.1 | -28.7 | 19.4 | 46.02 | -26.62 | 0-360 | 100 | V |
| 13 | * 962.4 | 28.8 | PK | 25.8 | -24.7 | 29.9 | 53.97 | -24.07 | 0-360 | 301 | V |
| 1 | 43.2175 | 37.29 | PK | 14.8 | -30.8 | 21.29 | 40 | -18.71 | 0-360 | 401 | H |
| 6 | 43.2175 | 47.67 | PK | 14.8 | -30.8 | 31.67 | 40 | -8.33 | 0-360 | 100 | V |
| 2 | 71.9475 | 38.24 | PK | 11.2 | -30.4 | 19.04 | 40 | -20.96 | 0-360 | 200 | H |
| 7 | 72.0325 | 42.59 | PK | 11.2 | -30.4 | 23.39 | 40 | -16.61 | 0-360 | 100 | V |
| 9 | 194.6025 | 40.65 | PK | 14.7 | -29.2 | 26.15 | 43.52 | -17.37 | 0-360 | 100 | V |
| 5 | 195.8775 | 43.9 | PK | 14.9 | -29.3 | 29.5 | 43.52 | -14.02 | 0-360 | 100 | H |

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

FCC Part 15 Subpart C 30-1000MHz.TST 30915 22 May 2014

Rev 9.5 09 May 2014


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# 9. AC MAINS LINE CONDUCTED EMISSIONS

## 9.1. LIMITS AND PROCEDURE

**LIMITS**

§15.207
IC RSS-GEN, Section 7.2.2

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency range (MHz) | Limits (dBµV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |
| Notes:<br>1. The lower limit shall apply at the transition frequencies<br>2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. | | |

**TEST PROCEDURE**

ANSI C63.4, 2009

**RESULTS**

No non-compliance noted:


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## 9.2. TYPE A, 424 KBPS

### 9.2.1. WITHOUT DUMMY LOAD

**6 WORST EMISSIONS**

Line-L1 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L1 (dB) | LC Cables 1&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .762 | 46.06 | PK | .3 | 0 | 46.36 | 56 | -9.64 | - | - |
| 2 | .762 | 33.1 | Av | .3 | 0 | 33.4 | - | - | 46 | -12.6 |
| 3 | 13.56 | 49.81 | PK | .2 | .2 | 50.21 | 60 | -9.79 | - | - |
| 4 | 13.56 | 44.67 | Av | .2 | .2 | 45.07 | - | - | 50 | -4.93 |
| 5 | 14.7255 | 43.51 | PK | .2 | .2 | 43.91 | 60 | -16.09 | - | - |
| 6 | 14.7255 | 37.83 | Av | .2 | .2 | 38.23 | - | - | 50 | -11.77 |

Line-L2 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L2 (dB) | LC Cables 2&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | .762 | 44.19 | PK | .3 | 0 | 44.49 | 56 | -11.51 | - | - |
| 8 | .762 | 27.81 | Av | .3 | 0 | 28.11 | - | - | 46 | -17.89 |
| 9 | 13.56 | 48.25 | PK | .3 | .2 | 48.75 | 60 | -11.25 | - | - |
| 10 | 13.56 | 42.89 | Av | .3 | .2 | 43.39 | - | - | 50 | -6.61 |
| 11 | 14.7255 | 42.51 | PK | .3 | .2 | 43.01 | 60 | -16.99 | - | - |
| 12 | 14.7255 | 37.54 | Av | .3 | .2 | 38.04 | - | - | 50 | -11.96 |

PK - Peak detector , Av - average detection


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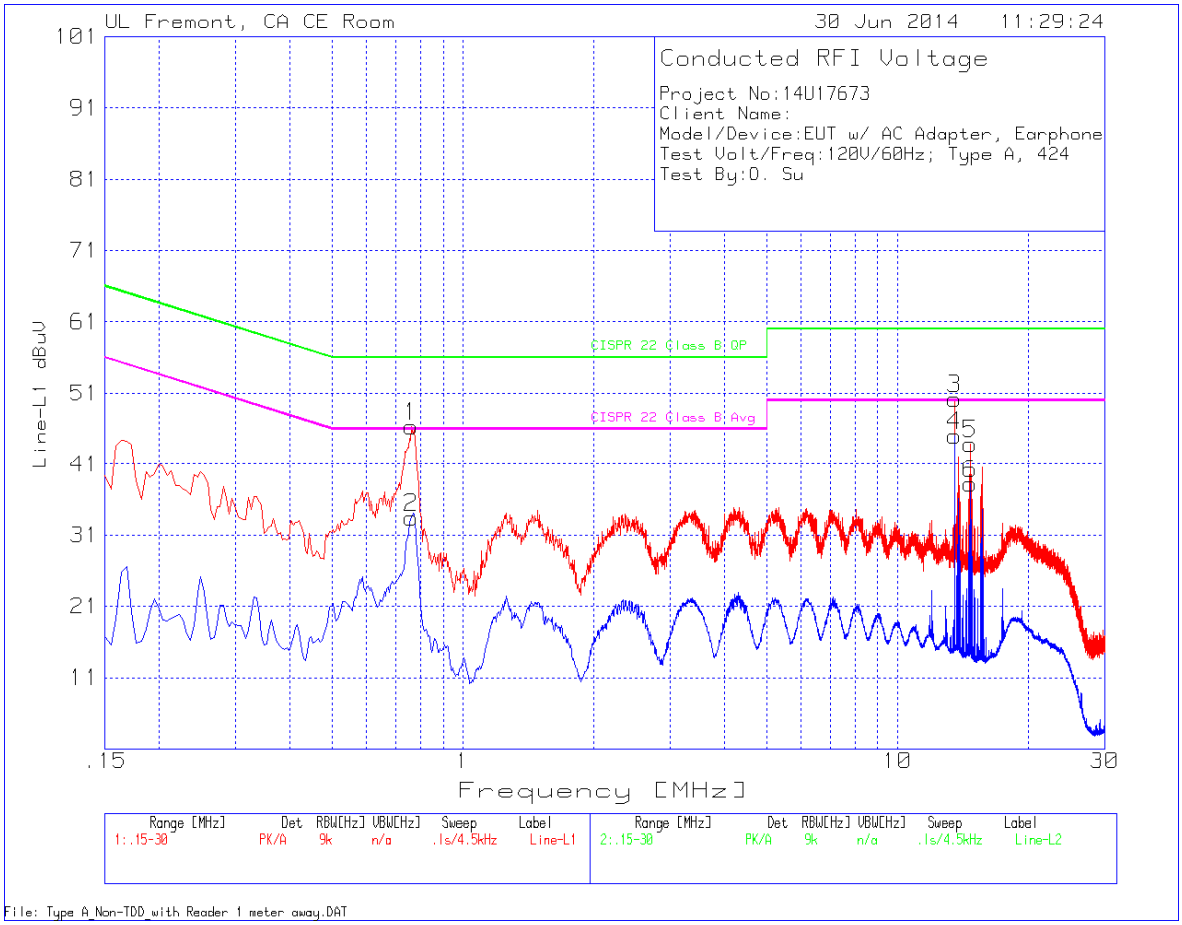
**LINE 1 RESULTS**







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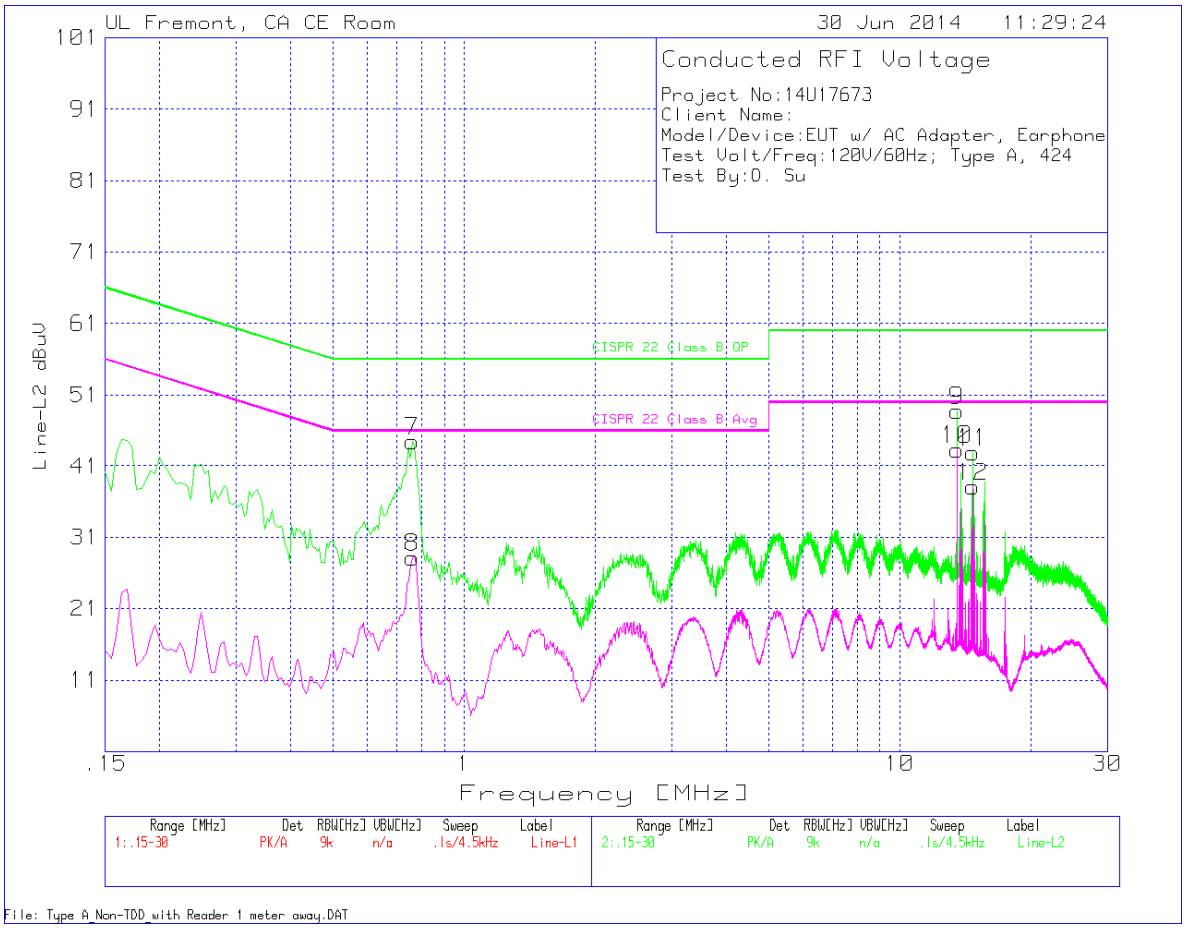
**LINE 2 RESULTS**





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## 9.2.2. WITH DUMMY LOAD

**6 WORST EMISSIONS**

Line-L1 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L1 (dB) | LC Cables 1&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .1635 | 47.97 | PK | 1.2 | 0 | 49.17 | 65.3 | -16.13 | - | - |
| 2 | .1635 | 35.01 | Av | 1.2 | 0 | 36.21 | - | - | 55.3 | -19.09 |
| 3 | .708 | 44.56 | PK | .3 | 0 | 44.86 | 56 | -11.14 | - | - |
| 4 | .708 | 22.41 | Av | .3 | 0 | 22.71 | - | - | 46 | -23.29 |
| 5 | 18.0915 | 37.3 | PK | .3 | .2 | 37.8 | 60 | -22.2 | - | - |
| 6 | 18.0915 | 21.36 | Av | .3 | .2 | 21.86 | - | - | 50 | -28.14 |

Line-L2 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L2 (dB) | LC Cables 2&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | .1545 | 48.44 | PK | 1.4 | 0 | 49.84 | 65.8 | -15.96 | - | - |
| 8 | .1545 | 30.95 | Av | 1.4 | 0 | 32.35 | - | - | 55.8 | -23.45 |
| 9 | .771 | 43.89 | PK | .3 | 0 | 44.19 | 56 | -11.81 | - | - |
| 10 | .771 | 23.8 | Av | .3 | 0 | 24.1 | - | - | 46 | -21.9 |
| 11 | 18.4515 | 35.53 | PK | .3 | .2 | 36.03 | 60 | -23.97 | - | - |
| 12 | 18.4515 | 21.85 | Av | .3 | .2 | 22.35 | - | - | 50 | -27.65 |

PK - Peak detector , Av - average detection


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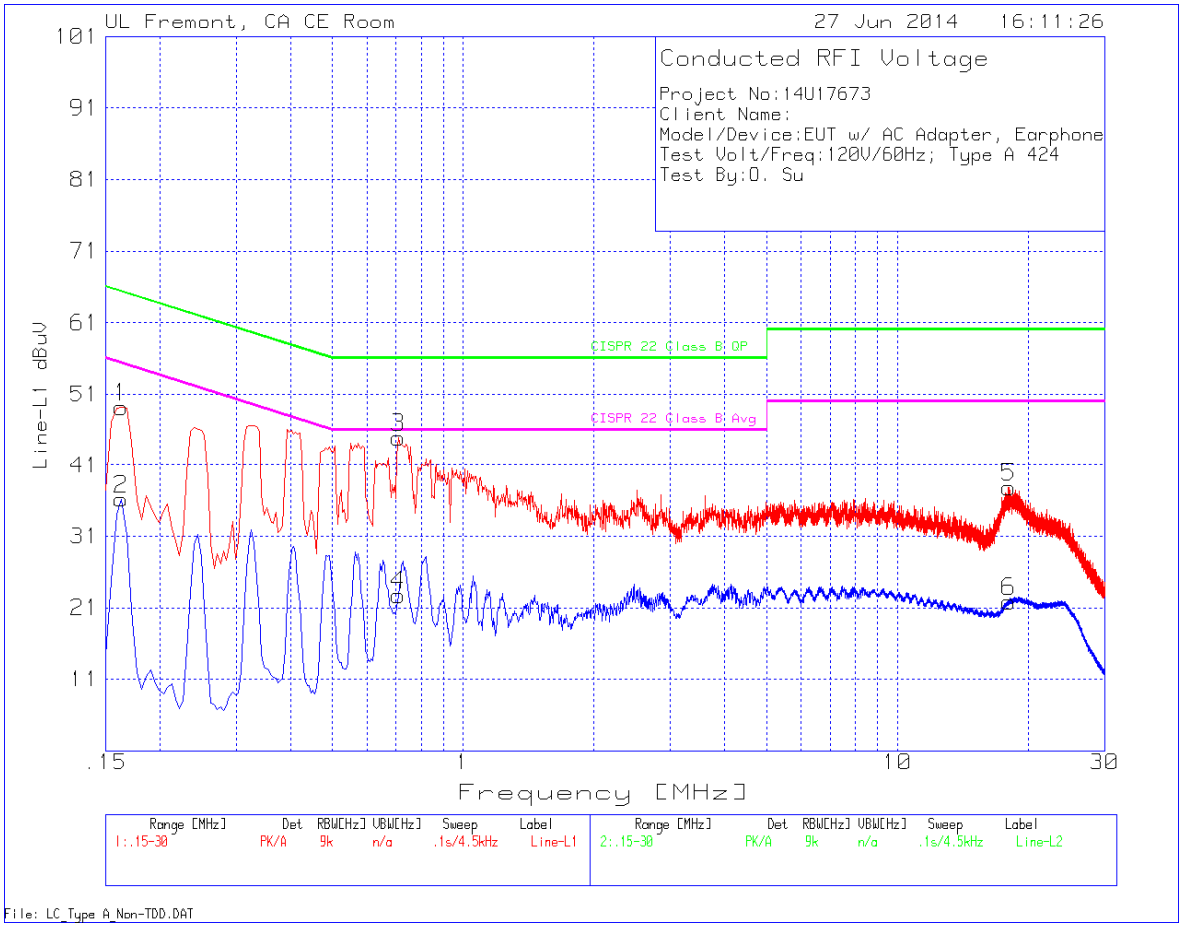
**LINE 1 RESULTS**





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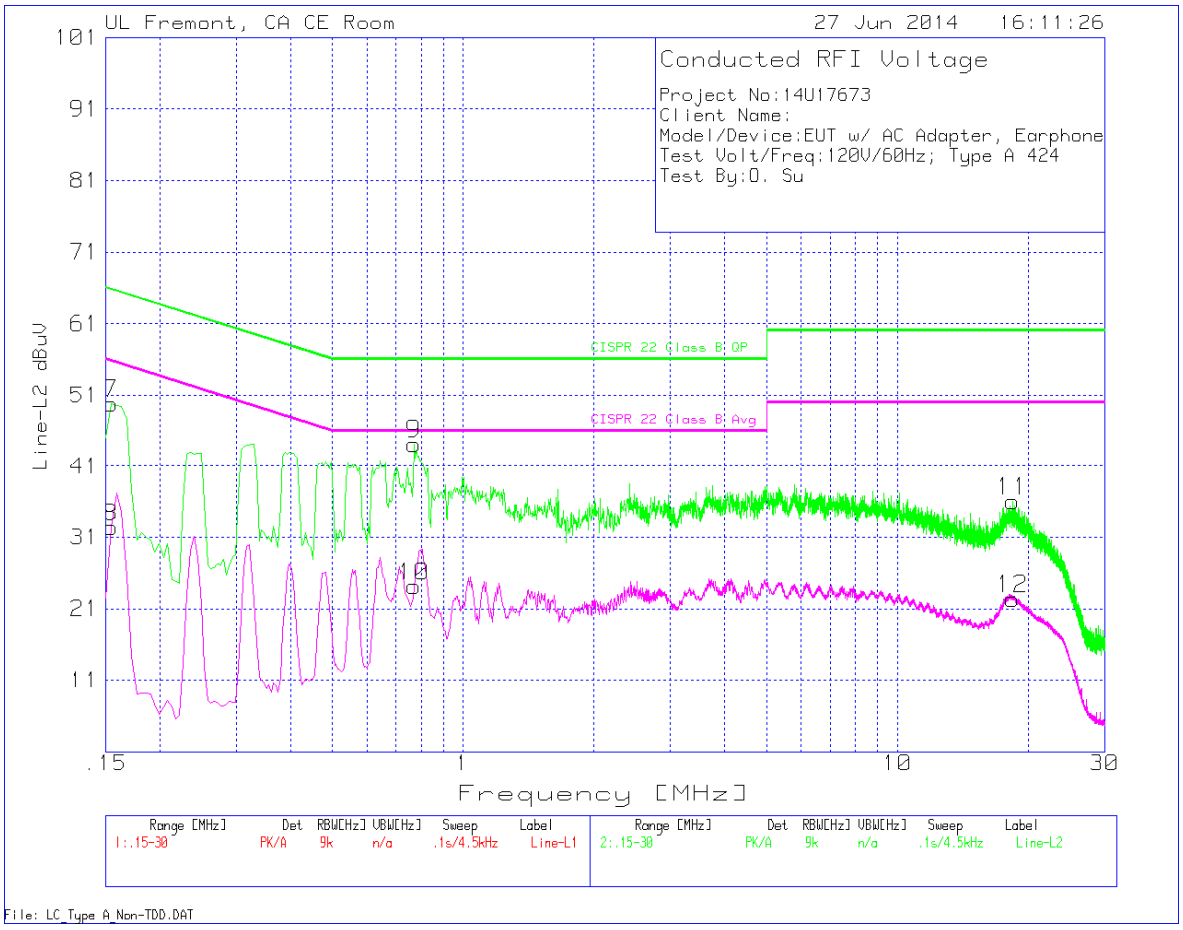
**LINE 2 RESULTS**





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## 9.3. TYPE B, 424 KBPS

### 9.3.1. WITHOUT DUMMY LOAD

**6 WORST EMISSIONS**

Line-L1 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L1 (dB) | LC Cables 1&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .1635 | 50.49 | PK | 1.2 | 0 | 51.69 | 65.3 | -13.61 | - | - |
| 2 | .1635 | 28.58 | Av | 1.2 | 0 | 29.78 | - | - | 55.3 | -25.52 |
| 3 | .7935 | 39.36 | PK | .3 | 0 | 39.66 | 56 | -16.34 | - | - |
| 4 | .7935 | 26.4 | Av | .3 | 0 | 26.7 | - | - | 46 | -19.3 |
| 7 | .7935 | 39.36 | PK | .3 | 0 | 39.66 | 56 | -16.34 | - | - |
| 8 | .7935 | 26.4 | Av | .3 | 0 | 26.7 | - | - | 46 | -19.3 |
| 5 | 14.4105 | 56.08 | PK | .2 | .2 | 56.48 | 60 | -3.52 | - | - |
| 6 | 14.4105 | 51.5 | Av | .2 | .2 | 51.9 | - | - | 50 | 1.9 |

Line-L2 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L2 (dB) | LC Cables 2&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | .1635 | 48.21 | PK | 1.3 | 0 | 49.51 | 65.3 | -15.79 | - | - |
| 10 | .1635 | 26.65 | Av | 1.3 | 0 | 27.95 | - | - | 55.3 | -27.35 |
| 11 | .5955 | 42.91 | PK | .3 | 0 | 43.21 | 56 | -12.79 | - | - |
| 12 | .5955 | 29.75 | Av | .3 | 0 | 30.05 | - | - | 46 | -15.95 |
| 13 | 14.4105 | 57.21 | PK | .3 | .2 | 57.71 | 60 | -2.29 | - | - |
| 14 | 14.4105 | 52.65 | Av | .3 | .2 | 53.15 | - | - | 50 | 3.15 |

PK - Peak detector , Av - average detection


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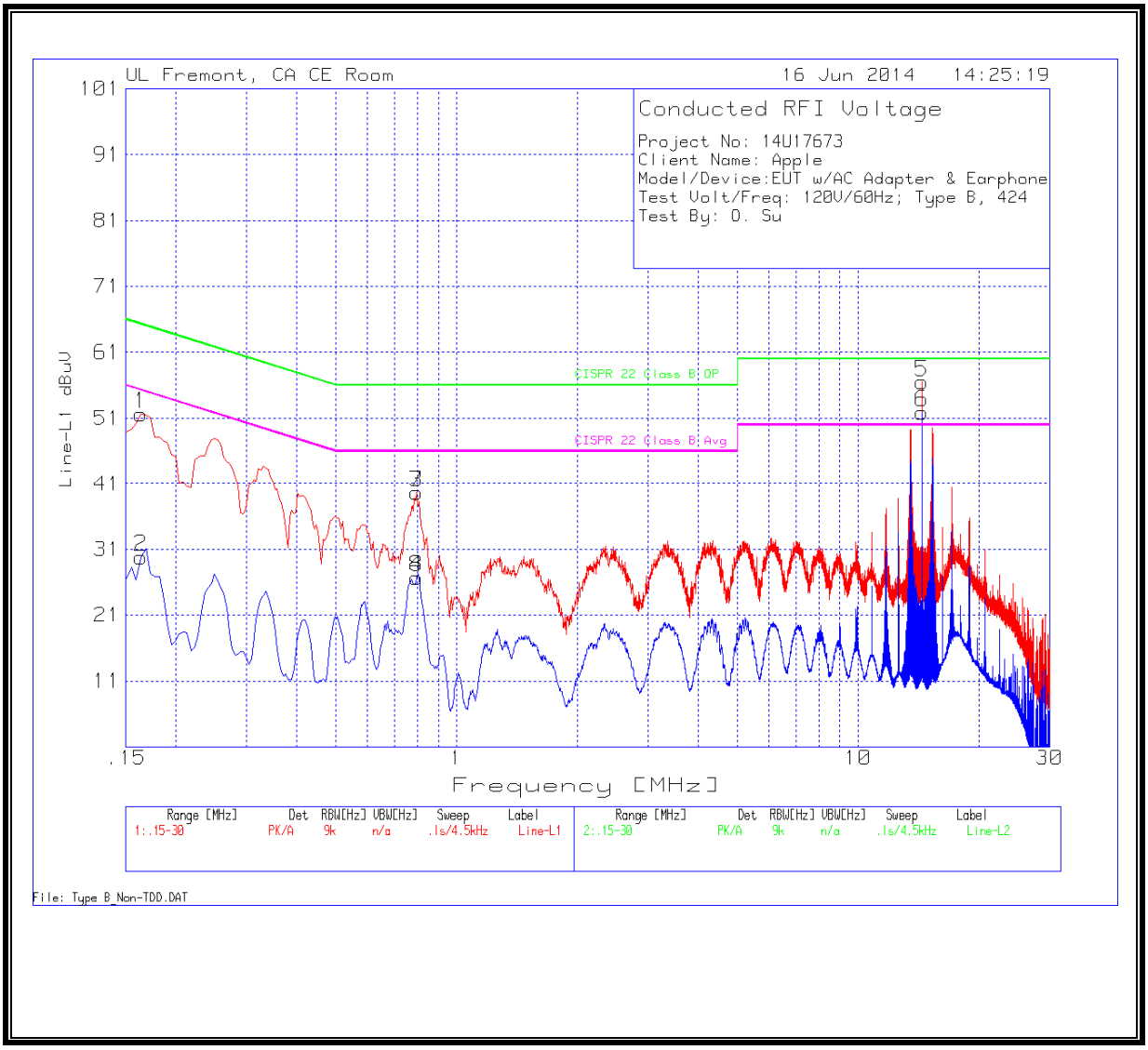
**LINE 1 RESULTS**







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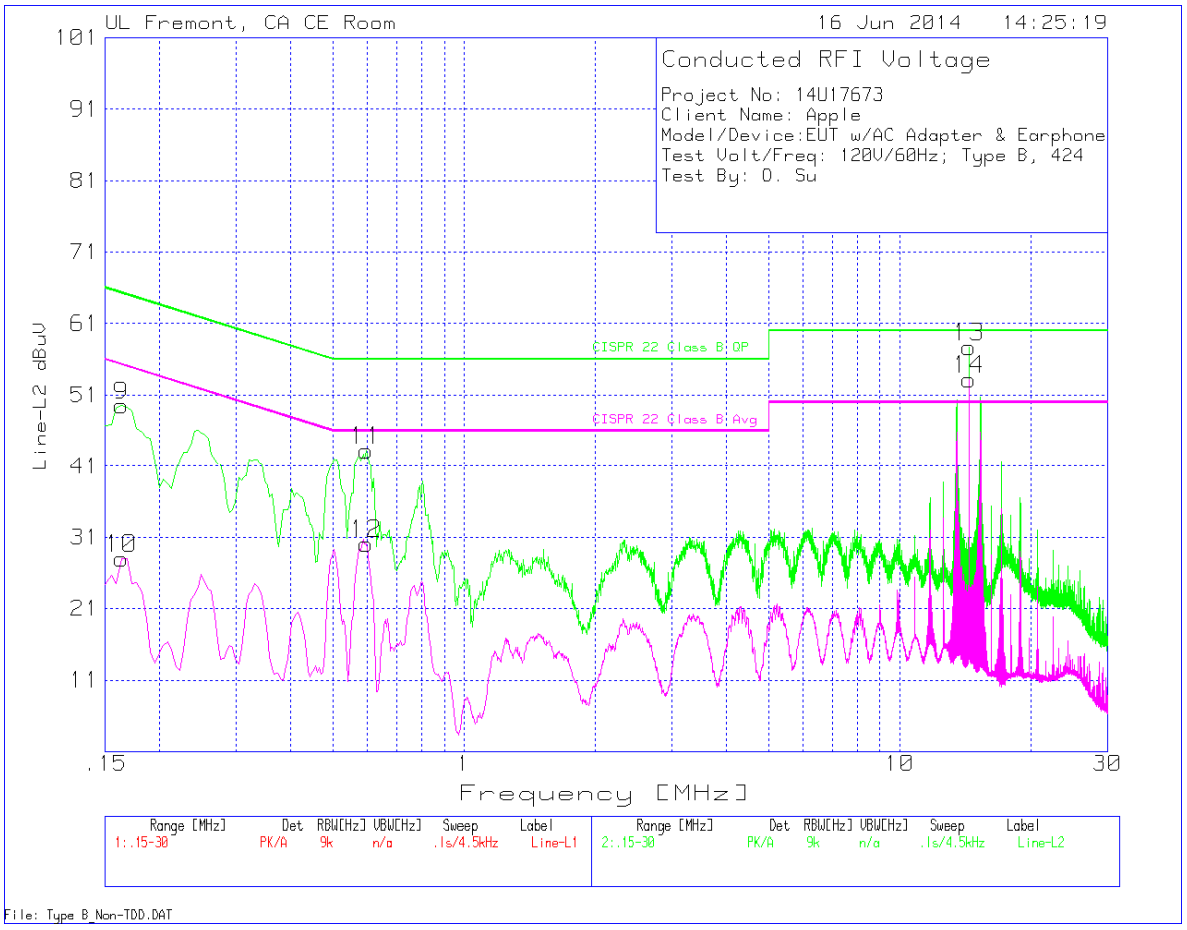
**LINE 2 RESULTS**





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## 9.3.2. WITH DUMMY LOAD

**6 WORST EMISSIONS**

### Line-L1 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L1 (dB) | LC Cables 1&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | .168 | 44.1 | PK | 1.2 | 0 | 45.3 | 65.1 | -19.8 | - | - |
| 2 | .168 | 25.23 | Av | 1.2 | 0 | 26.43 | - | - | 55.1 | -28.67 |
| 3 | .7575 | 44.63 | PK | .3 | 0 | 44.93 | 56 | -11.07 | - | - |
| 4 | .7575 | 29.43 | Av | .3 | 0 | 29.73 | - | - | 46 | -16.27 |
| 5 | 18.492 | 29.23 | PK | .3 | .2 | 29.73 | 60 | -30.27 | - | - |
| 6 | 18.492 | 12.63 | Av | .3 | .2 | 13.13 | - | - | 50 | -36.87 |

### Line-L2 .15 - 30MHz

**Trace Markers**

| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | T24 IL L2 (dB) | LC Cables 2&3 (dB) | Corrected Reading dBuV | CISPR 22 Class B QP | Margin to Limit (dB) | CISPR 22 Class B Avg | Margin to Limit (dB) |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | .168 | 43.56 | PK | 1.3 | 0 | 44.86 | 65.1 | -20.24 | - | - |
| 8 | .168 | 25.8 | Av | 1.3 | 0 | 27.1 | - | - | 55.1 | -28 |
| 9 | .7665 | 45.35 | PK | .3 | 0 | 45.65 | 56 | -10.35 | - | - |
| 10 | .7665 | 31.74 | Av | .3 | 0 | 32.04 | - | - | 46 | -13.96 |
| 11 | 18.465 | 27.12 | PK | .3 | .2 | 27.62 | 60 | -32.38 | - | - |
| 12 | 18.465 | 16.51 | Av | .3 | .2 | 17.01 | - | - | 50 | -32.99 |

PK - Peak detector , Av - average detection


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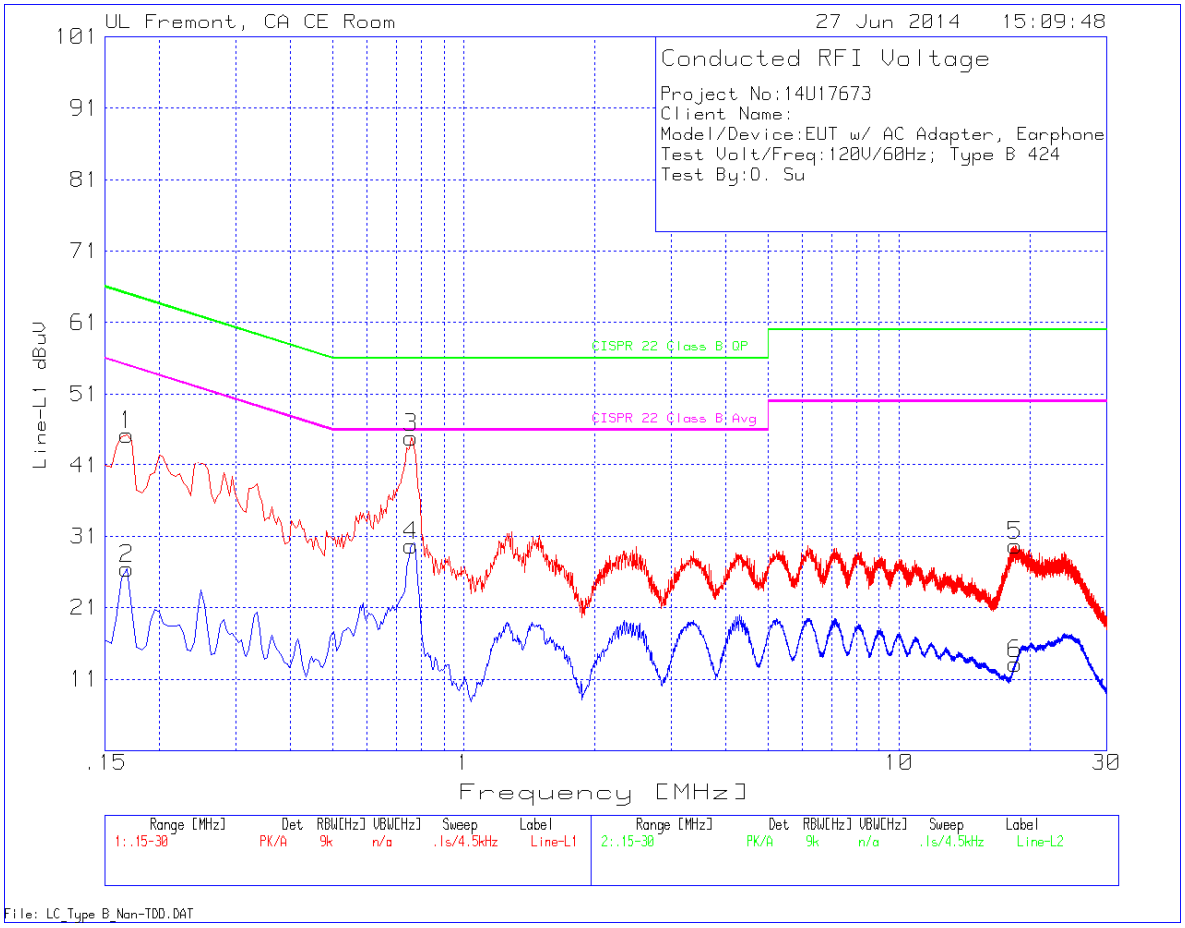
**LINE 1 RESULTS**



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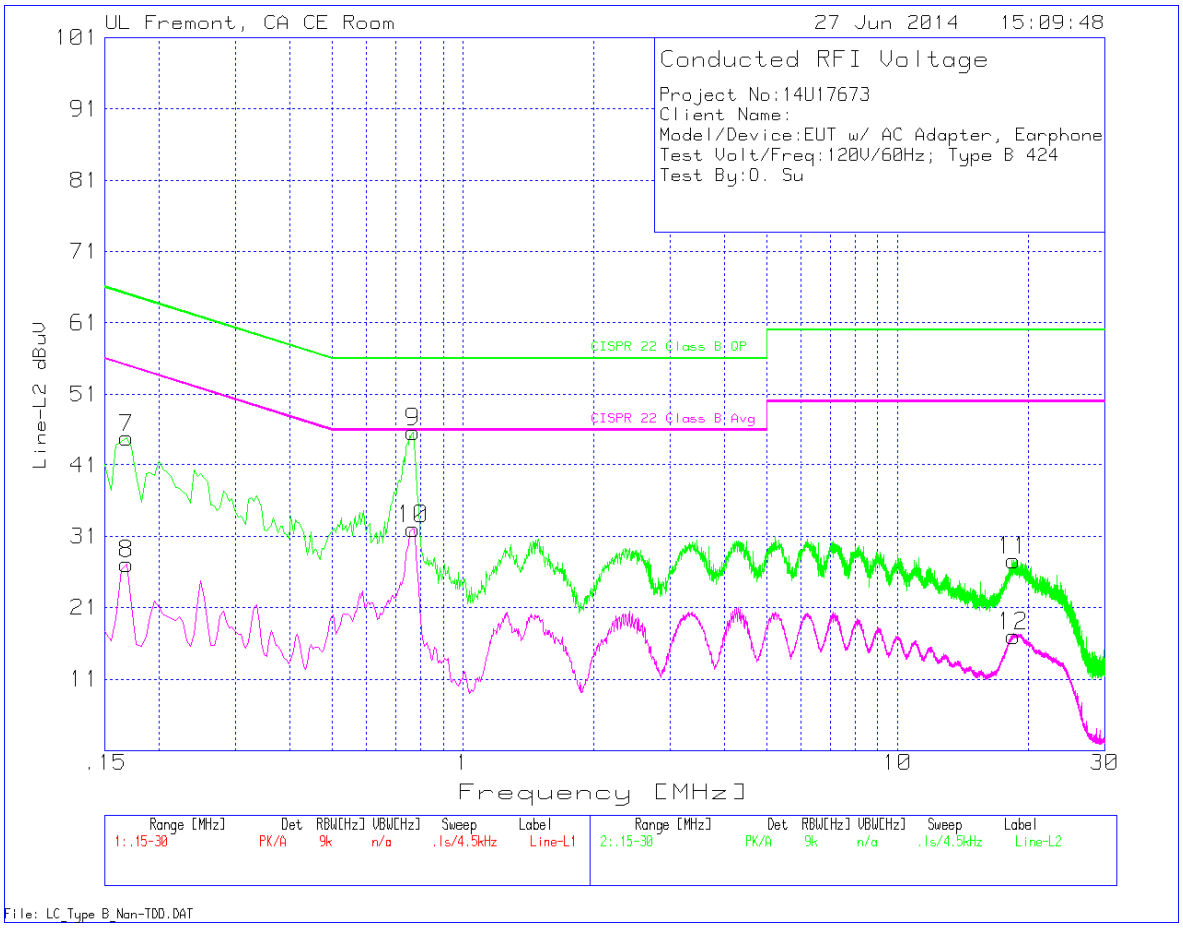
**LINE 2 RESULTS**





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# 10. FREQUENCY STABILITY

**LIMIT**

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within ±0.01% of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

**TEST PROCEDURE**

ANSI / TIA / EIA 603 Clause 2.3.1 and 2.3.2

**RESULTS**

No non-compliance noted.

**TYPE A, 424 Kbps**

| Reference Frequency: EUT Channel 13.560 MHz @ 20ºC<br>Limit: ± 100 ppm = 1.356 kHz | | | | |
|---|---|---|---|---|
| **Power Supply (Vdc)** | **Environment Temperature (ºC)** | **Frequency Deviation Measureed with Time Elapse** | | |
| | | **(MHz)** | **Delta (ppm)** | **Limit (ppm)** |
| 3.80 | 50 | 13.5602167 | -0.804 | ± 100 |
| 3.80 | 40 | 13.5602150 | -0.678 | ± 100 |
| 3.80 | 30 | 13.5602165 | -0.789 | ± 100 |
| ***3.80*** | ***20*** | ***13.5602058*** | ***0.000*** | ***± 100*** |
| 3.80 | 10 | 13.5602154 | -0.708 | ± 100 |
| 3.80 | 0 | 13.5602148 | -0.664 | ± 100 |
| 3.80 | -10 | 13.5602139 | -0.597 | ± 100 |
| 3.80 | -20 | 13.5602132 | -0.546 | ± 100 |
| 3.40 | 20 | 13.5602078 | -0.147 | ± 100 |
| 4.30 | 20 | 13.5602088 | -0.221 | ± 100 |


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**TYPE B, 424Kbps**

| Reference Frequency: EUT Channel 13.560 MHz @ 20ºC<br>Limit: ± 100 ppm = 1.356 kHz | | | | |
|---|---|---|---|---|
| **Power Supply (Vdc)** | **Environment Temperature (ºC)** | **Frequency Deviation Measureed with Time Elapse** | | |
| | | **(MHz)** | **Delta (ppm)** | **Limit (ppm)** |
| 3.80 | 50 | 13.5602128 | -0.796 | ± 100 |
| 3.80 | 40 | 13.5602130 | -0.811 | ± 100 |
| 3.80 | 30 | 13.5602142 | -0.900 | ± 100 |
| ***3.80*** | ***20*** | ***13.5602020*** | ***0.000*** | ***± 100*** |
| 3.80 | 10 | 13.5602142 | -0.900 | ± 100 |
| 3.80 | 0 | 13.5602140 | -0.885 | ± 100 |
| 3.80 | -10 | 13.5602132 | -0.826 | ± 100 |
| 3.80 | -20 | 13.5602129 | -0.804 | ± 100 |
| 3.40 | 20 | 13.5602025 | -0.037 | ± 100 |
| 4.30 | 20 | 13.5602028 | -0.059 | ± 100 |


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